

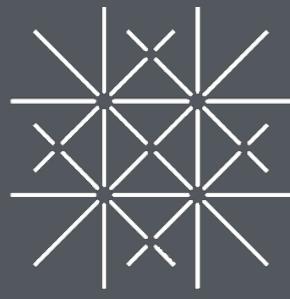
# Two Modes of Learning and the **Description-Experience Gap**

Dirk U. Wulff

University of Basel

Max-Planck-Institute for Human Development

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UNI  
BASEL



Drosophila Melanogaster



# Monetary gambles

,,Would you rather have A or B?“

**A**

4€ with p=.8  
otherwise 0

**B**

3€ with p=1

**Allais Paradox** (Allais, 1953)

**Certainty effect** (Kahneman & Tversky, 1979)

**Reflection effect** (Kahneman & Tversky, 1979)

**Loss aversion** (Kahneman & Tversky, 1979)

**Framing effects** (Kahneman & Tversky, 1984)

**Risk aversion** (Holt & Laury's, 2002)

(Ambiguity aversion) (Ellsberg, 1961)

# Experience





Frank H. Knight  
1885-1972

Statistical probabilities  
*'I know something land'*



Uncertainty  
*'I know  
nothing land'*

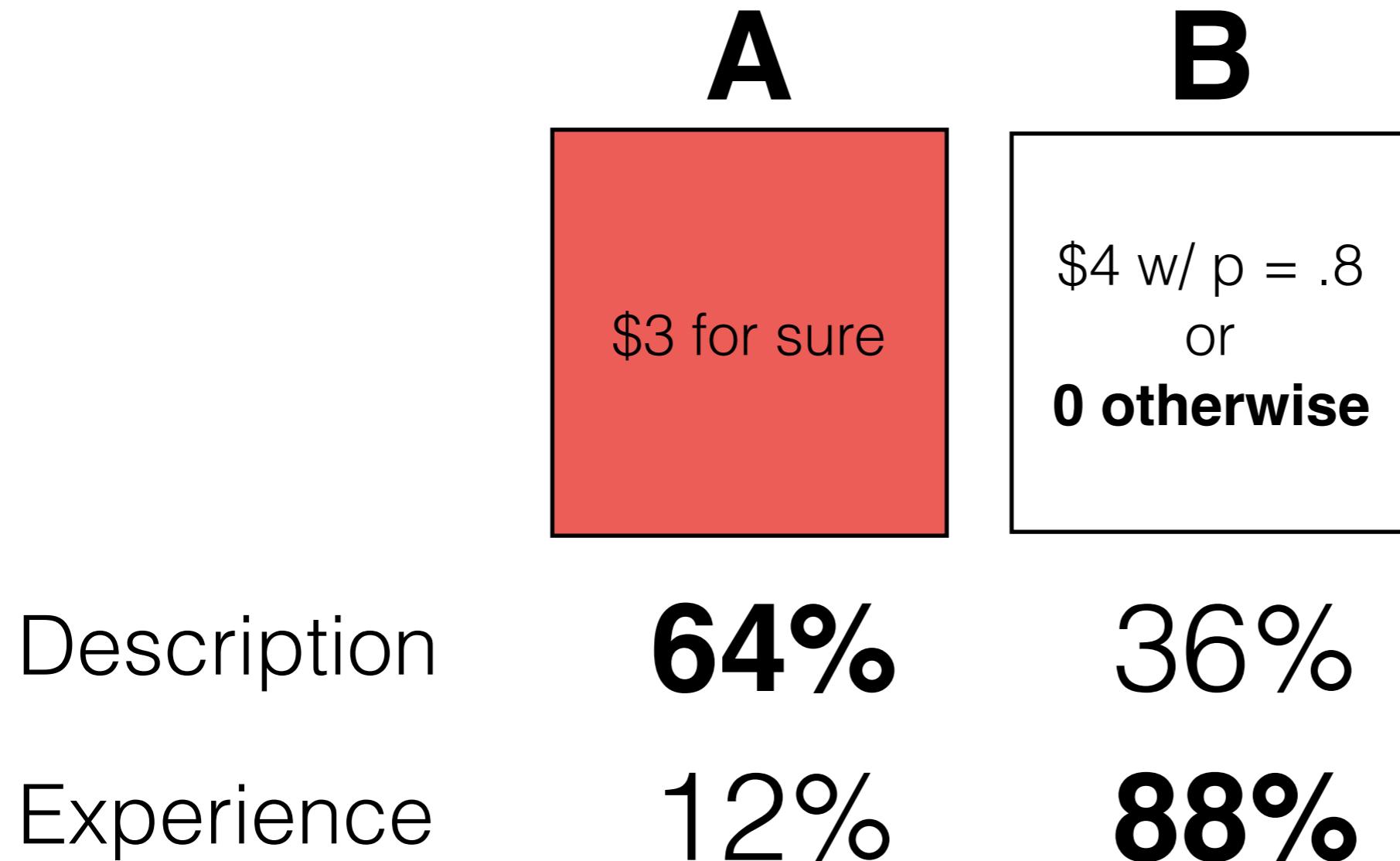


Risk  
*'I know  
probabilities  
land'*

Certainty  
*'I know  
everything  
land'*

# Description-experience gap

and the weighting of small probability events



# Agenda

**Today** Description-experience gap

- 1 Interactive Experience the gap
- 2 A meta analysis on the gap
- 3 Determinants of the gap
- 4 Interactive Reverse-engineering the gap
- 5 Conclusion

**Tomorrow** Modes of learning and risk communication

- 1 Introduction
- 2 Interactive Experience Risk tool(s)
- 3 Modes of learning shape risk perception

**Interactive element**

Experience the gap

# EADM summer school 2018

*Dirk Wulff*

## Mouse-tracking

### Get ready

Please download and install:

[R](#)  
[RStudio](#)

Then run in RStudio's console window (run = copy & paste into the window and press ENTER):

```
install.packages('mousetrap')
```

If you encounter any problems please [email](#) me.

Get Mac OS (High Sierra) [binary](#)

### Sessions

Intro to R

[slides](#), [Interactive](#)

Trajectory types

[slides](#), [Interactive](#)

## Decisions from Experience

### Sessions

Modes of learning and the description-experience gap

Slides: [link](#)

Interactive 1: [link](#) 

Interactive 2: [link](#), [predictions](#)

Modes of learning and risk perception

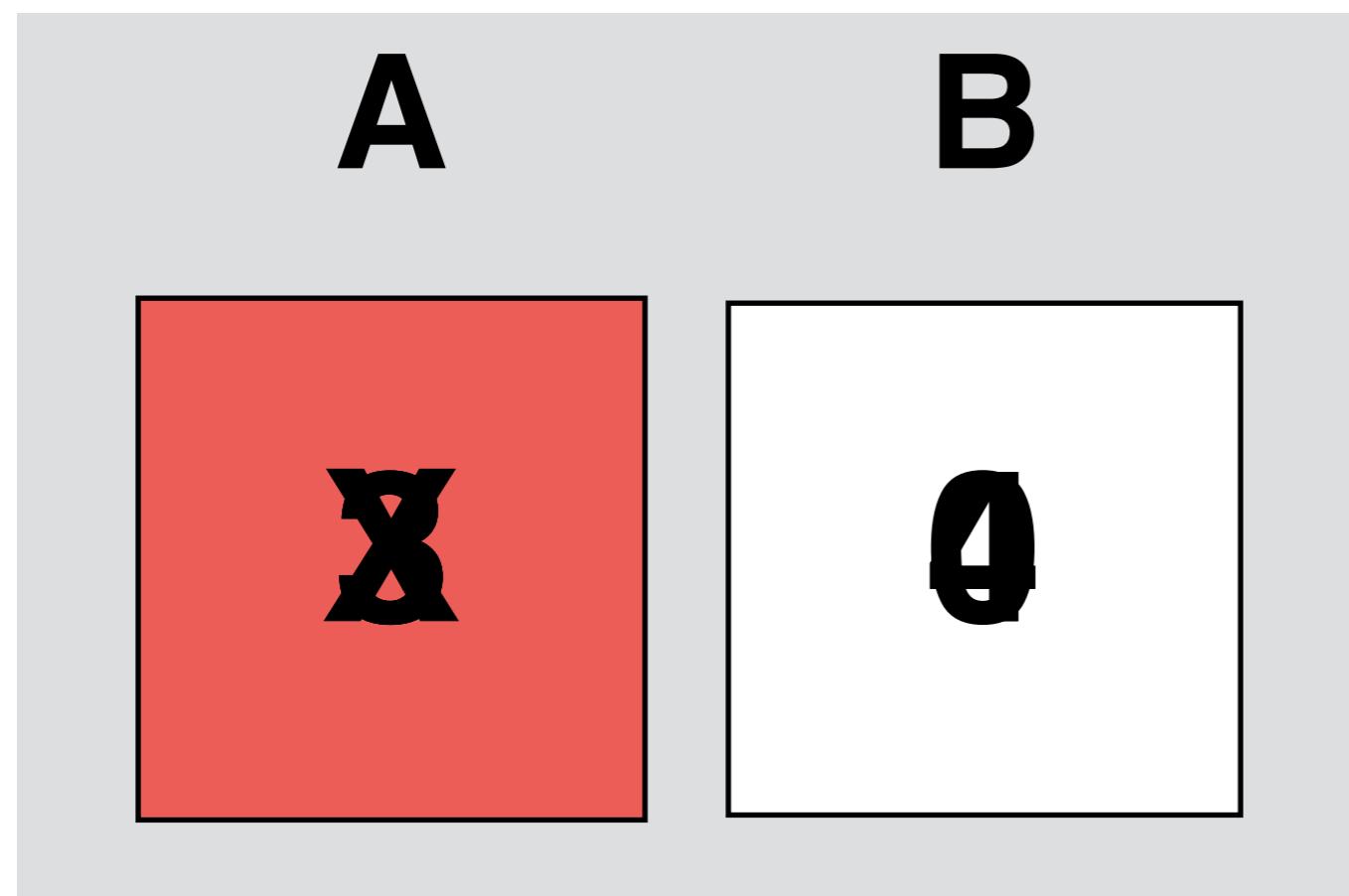
Slides: [link](#)

Interactive: [link](#), [data](#), [results](#)

How robust is the gap and  
why does it occur?

# Decisions from Experience

*The sampling paradigm*



- (1) Choice between two Lotteries
- (2) No prior information
- (3) Search for as long as desired
- (4) When ready, terminate search and make a choice.

# Data

Sampling paradigm

## Experience

**4,400** Ppt  
45,240 Choices.

*autonomous*

*matched*

*regulated*



**2,643**  
45,240



**226**  
977



**1,521**  
4,016

## Description

**2,208** Ppt  
31,353 Choices



# How to measure the gap?

Defintion 1

## Discrete underweighting

In favor of the option with the rare event if it is desirable, and against the option with the rare event if it is undesirable. A rare event is the event with the smallest probability between both options.

Defintion 2

## CPT-based

In favor of the option predicted by cumulative prospect theory (CPT) using the parameter values derived by Tversky and Kahneman (1992).

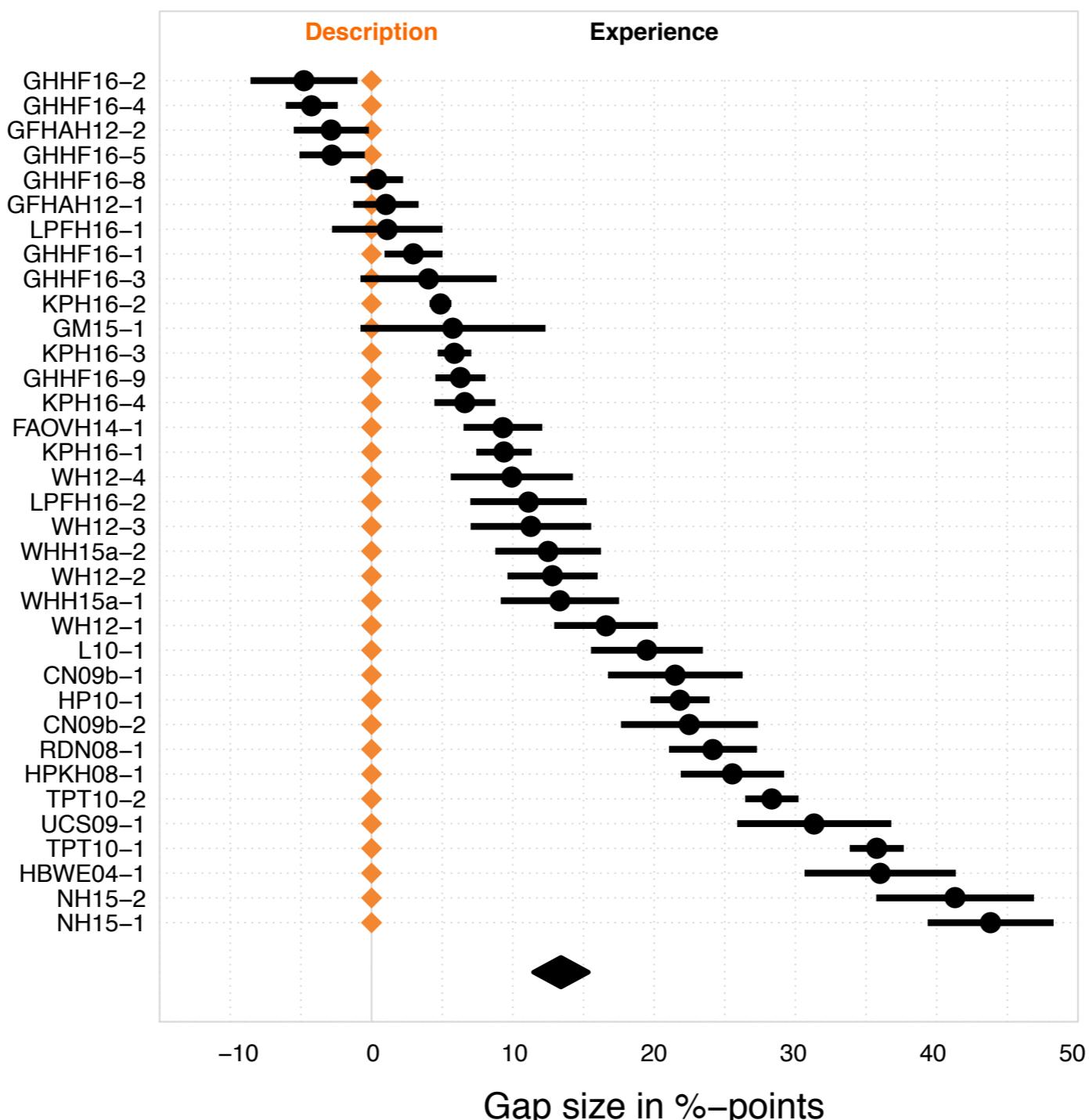
A

\$3 for sure

B

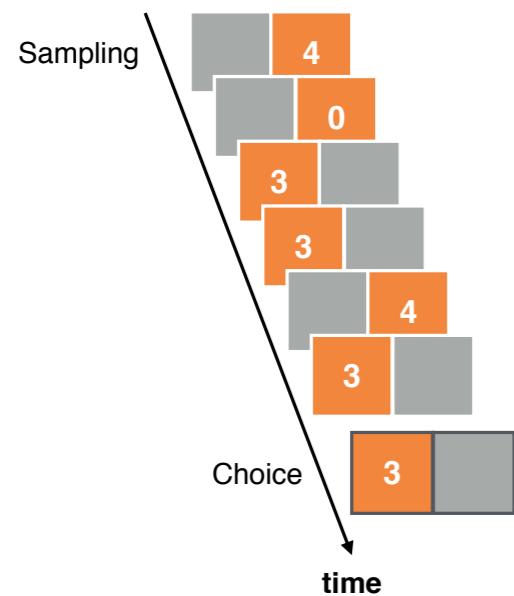
\$4,  $p = .8$   
or  
**0 otherwise**

# A robust Gap

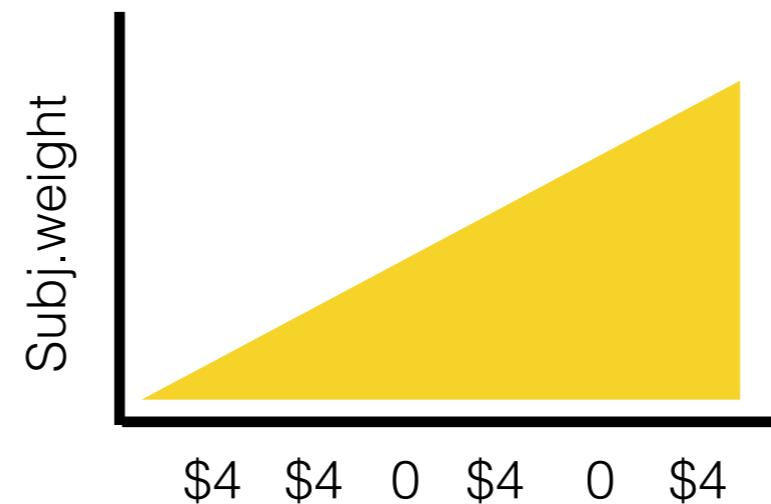


# Determinants of the Gap

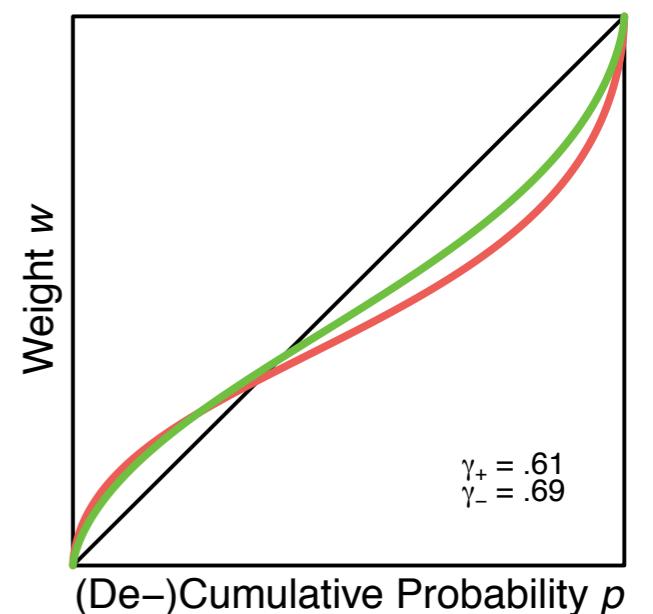
I: Small samples



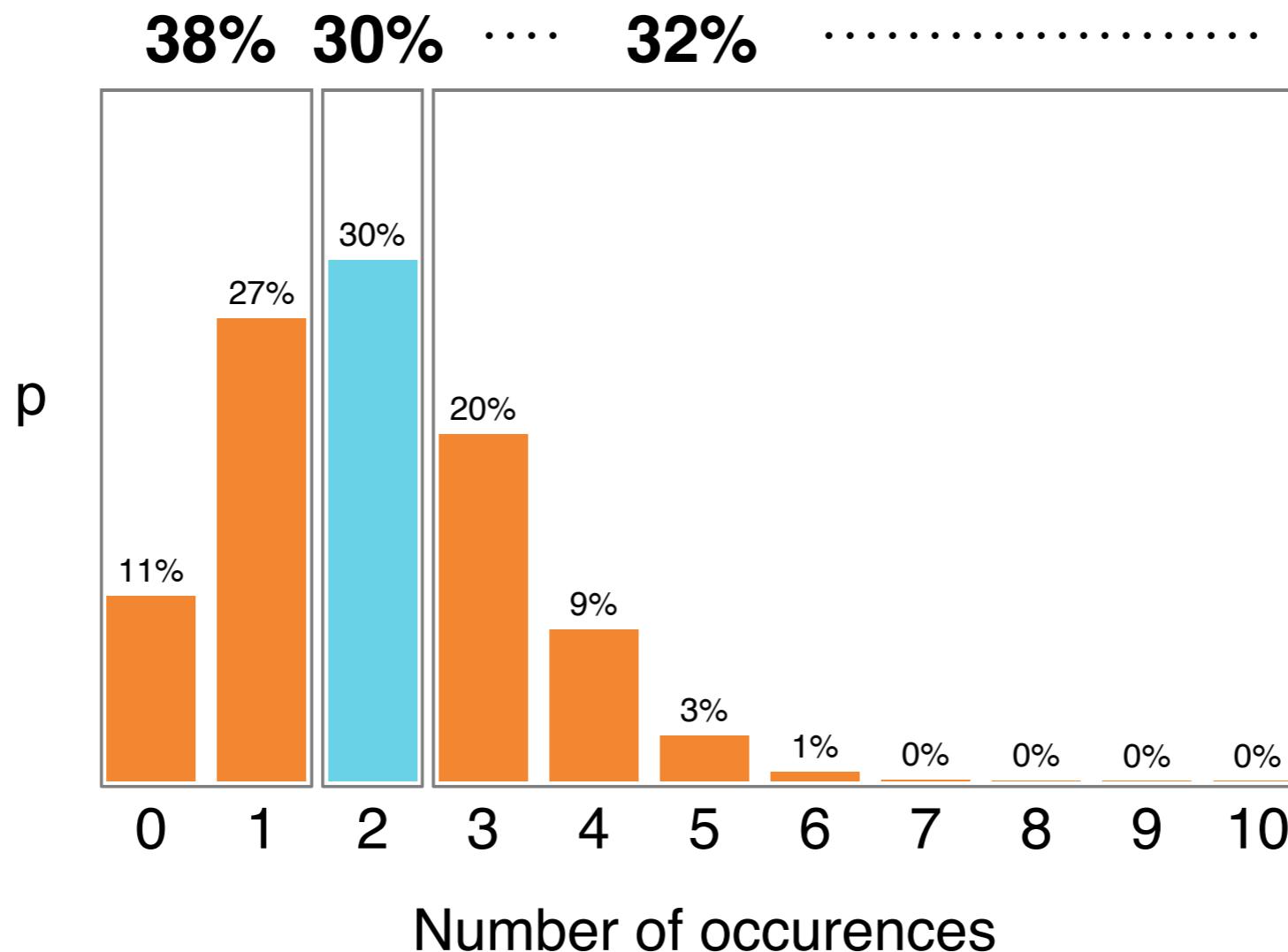
II: Order effects



III: Prob. weighting

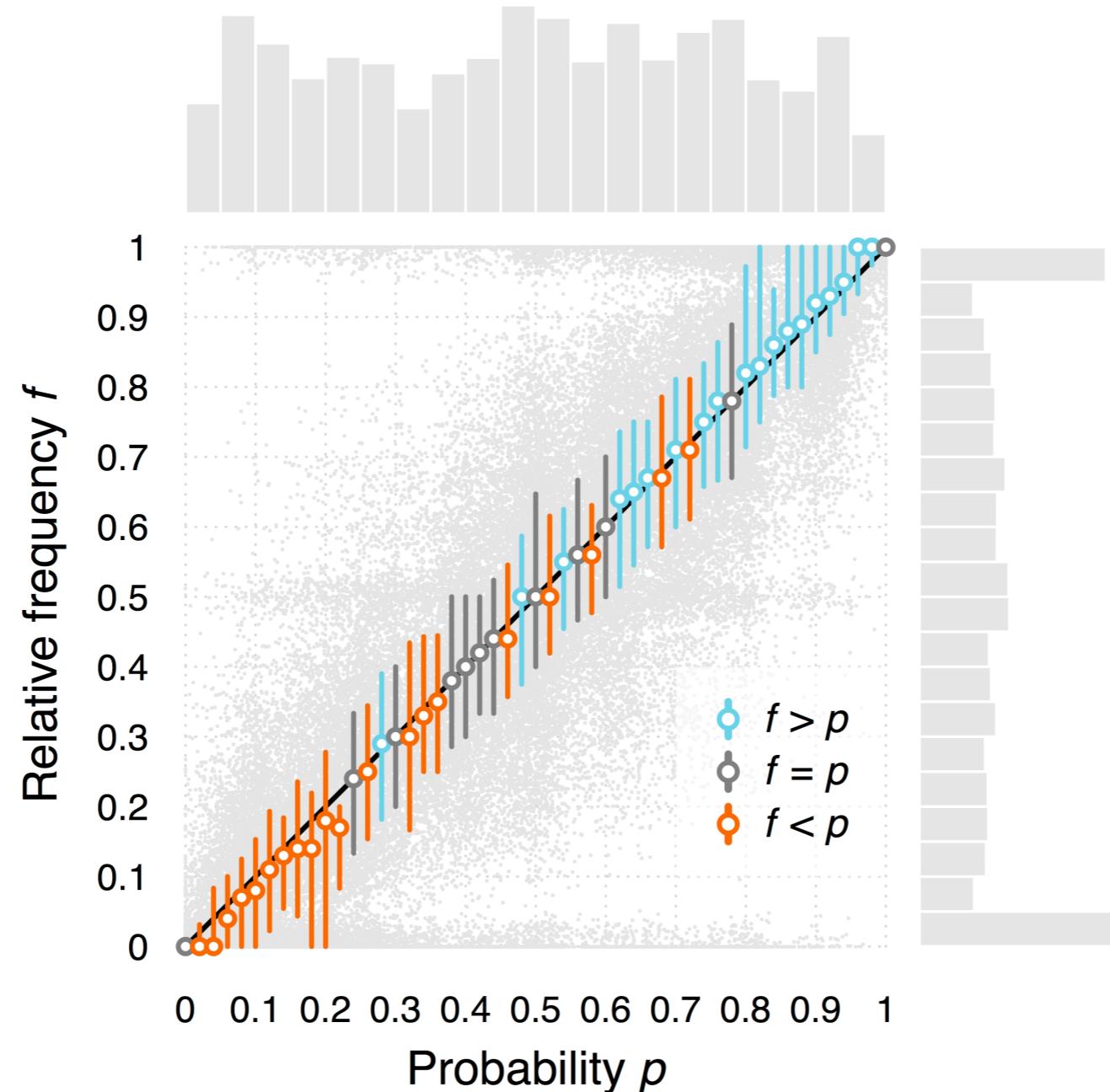


# Small samples suppress rare events



# Small samples polarise

experienced relative frequencies vs. probabilities

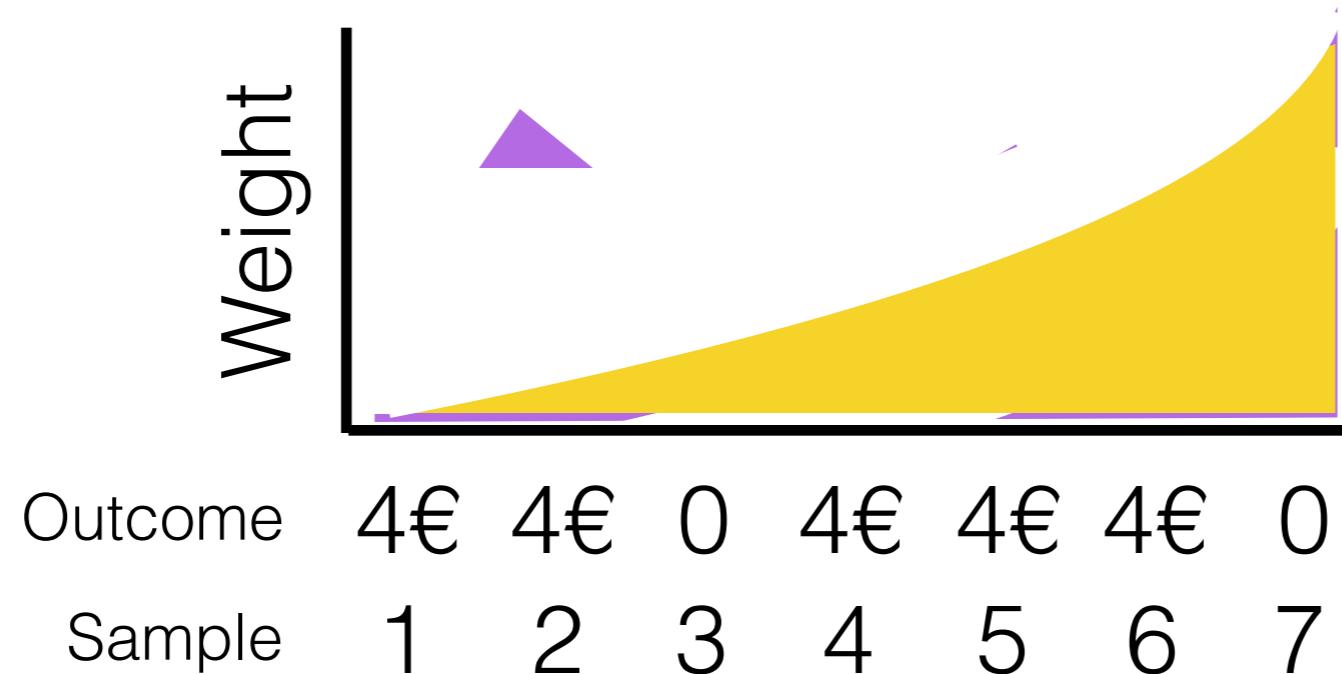


# Small sample sizes increase (as-if) underweighting



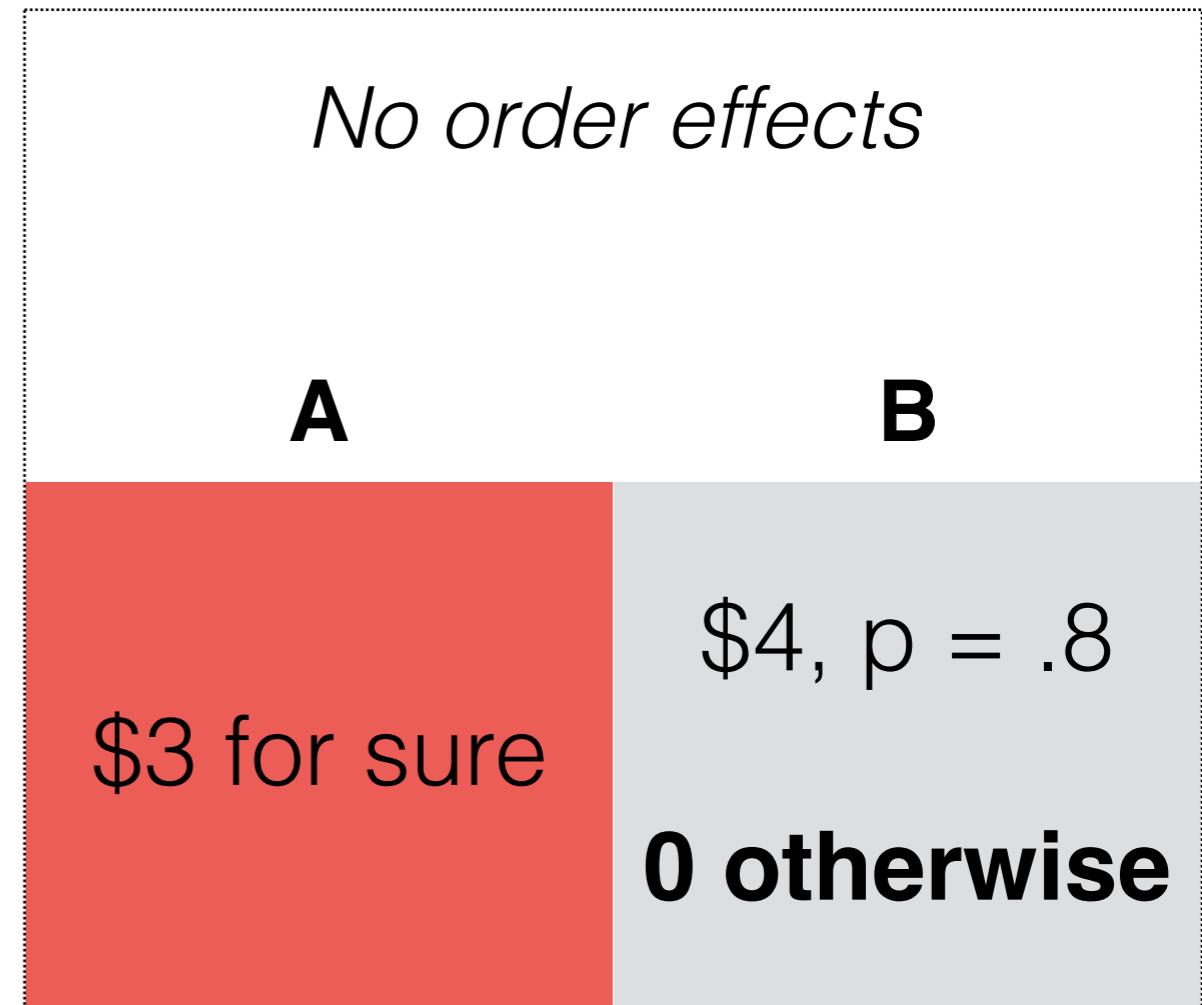
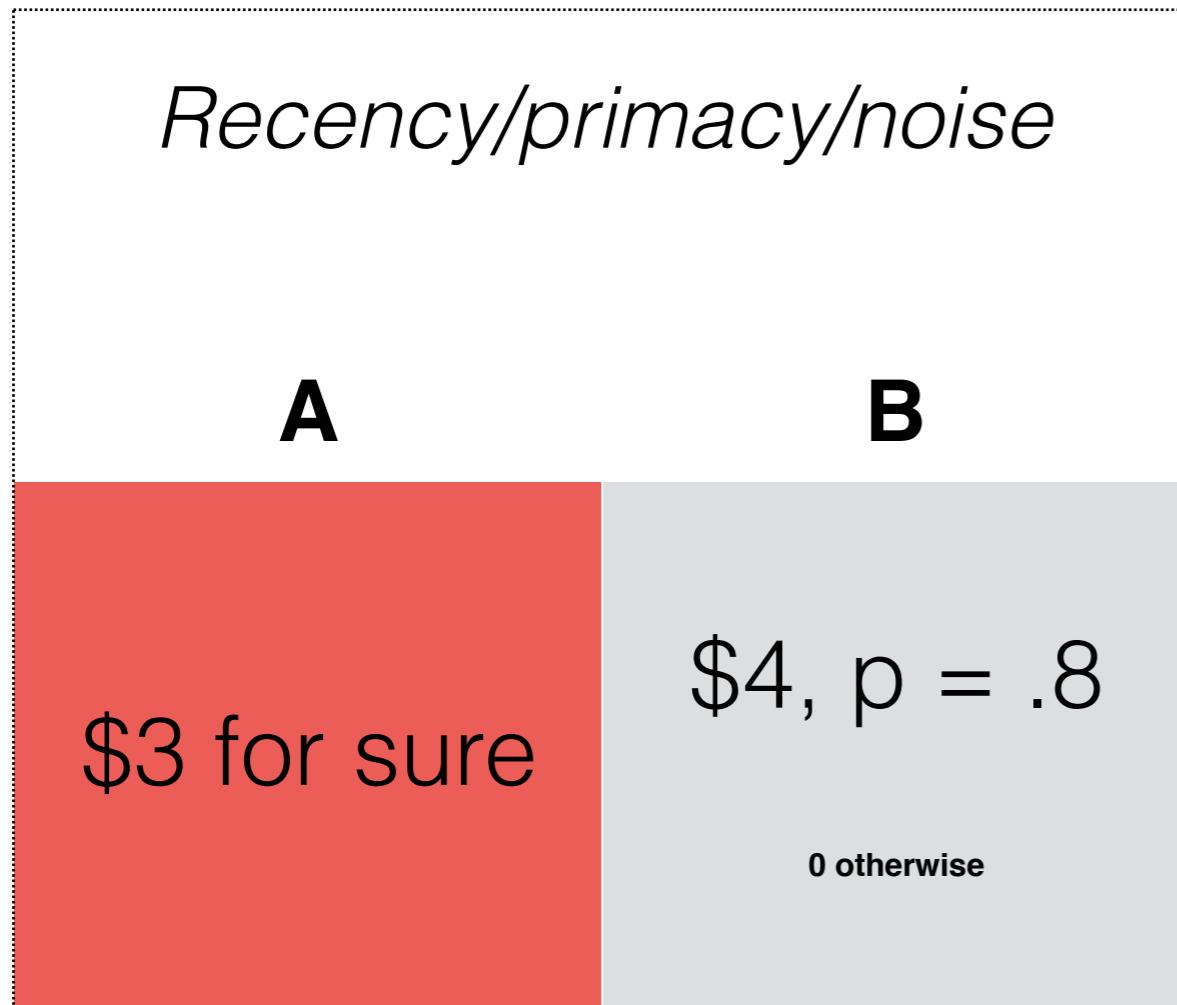
# Order effects

Position-dependent weighting



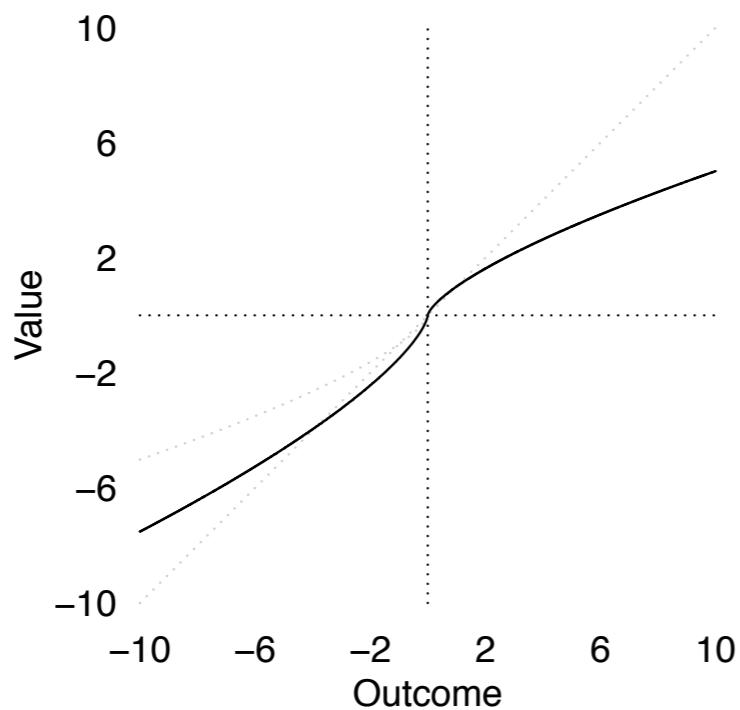
# Order effects

increase (as-if) underweighting

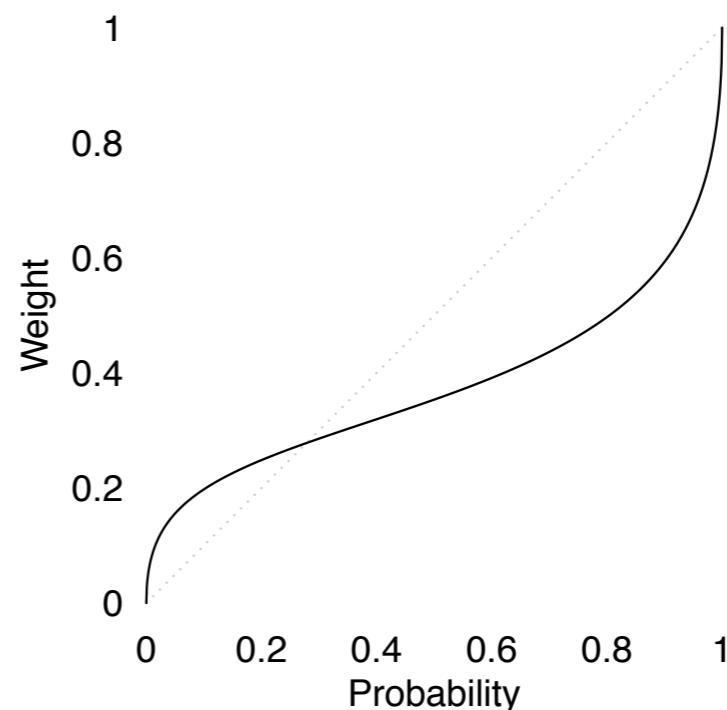


# Experience (may) elicit(s) linear probability weighting

$$v = \begin{cases} x^\alpha, & \text{if } x \geq 0 \\ \lambda x^\alpha, & \text{if } x < 0 \end{cases}$$



$$w = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{1/\gamma}}$$



# High gamma ( $> 1$ )

implies underweighting

$\gamma > 1$	
A	B
\$3 for sure	\$4, p = .8 0 otherwise

$\gamma = 1$	
A	B
\$3 for sure	\$4, p = .8 <b>0 otherwise</b>

# Low gamma (<1)

implies overweighting

$\gamma < 1$	
A	B
\$3 for sure	\$4, p = .8 0 otherwise

$\gamma = 1$	
A	B
\$3 for sure	\$4, p = .8 <b>0 otherwise</b>

# **Interactive element**

## Reverse-engineering the Gap

# Exploring the Gap

Per-option sample size



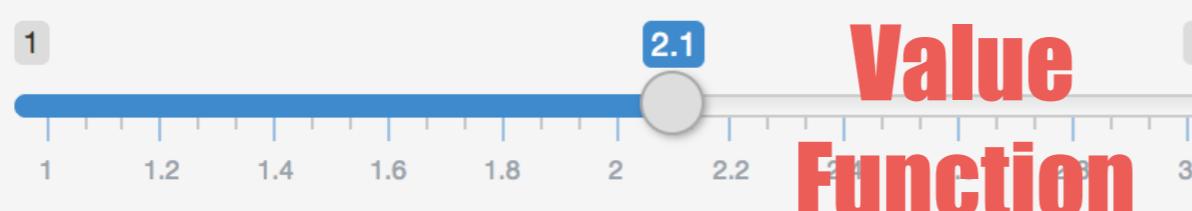
## Sample size distribution

CPT - alpha



## Value Function

CPT - lambda



## Value Function

CPT - gamma



## Weighting Function

Recency



## Position Weighting

Noise



## Position Weighting

## Sample size distribution

Mean

Per-option sample size

## Position Weighting

Relative position

## Weighting Function

## MSE

.034

## Histogram

## DfE

## MSE

## Value Function

## Weighting Function

## Irrelevant Information

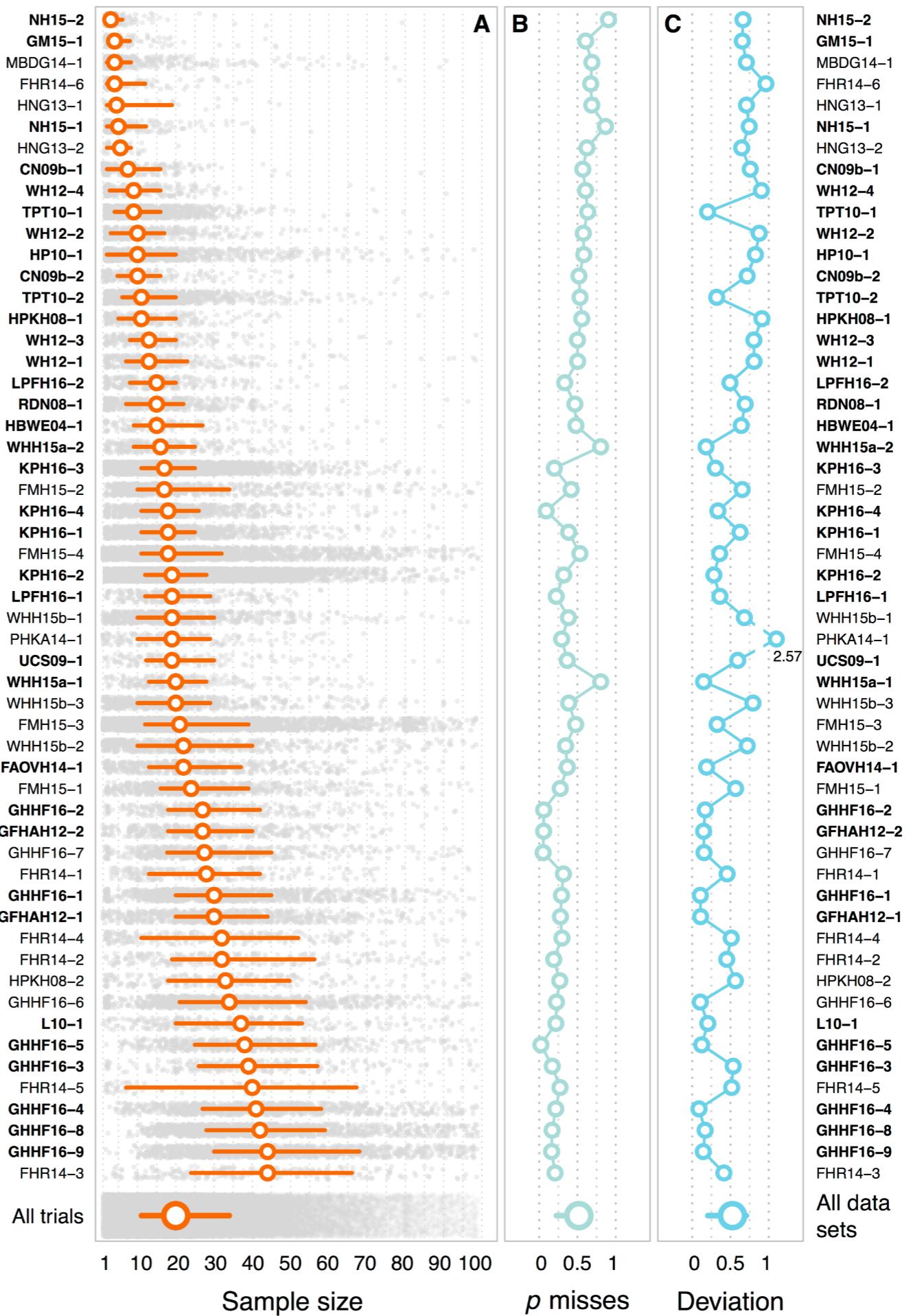
## Scatterplot

## DfE x DfE

## MSE Experience

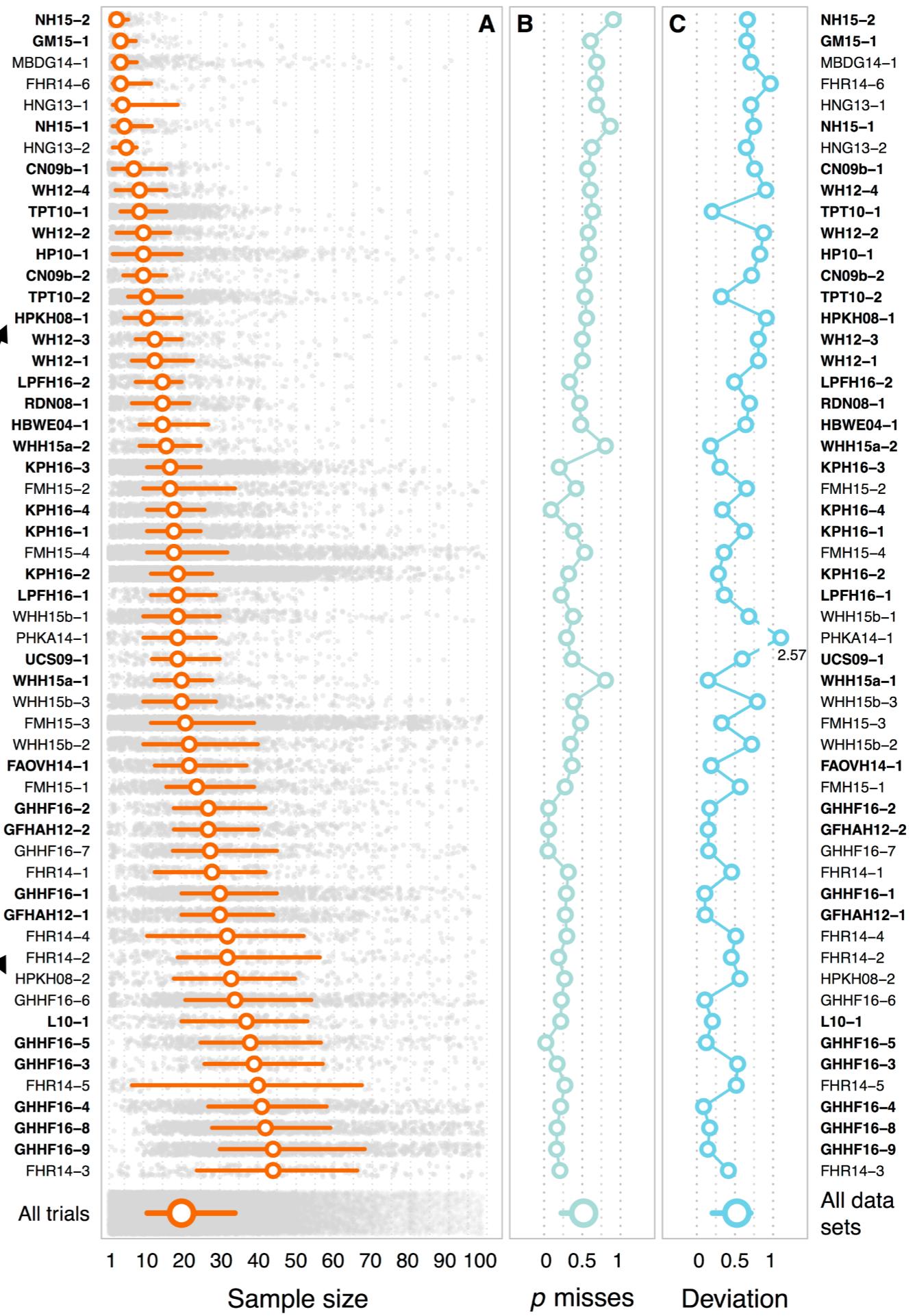
What have we learned  
about the key drivers of  
the gap?

# Sample size outcome misses & error



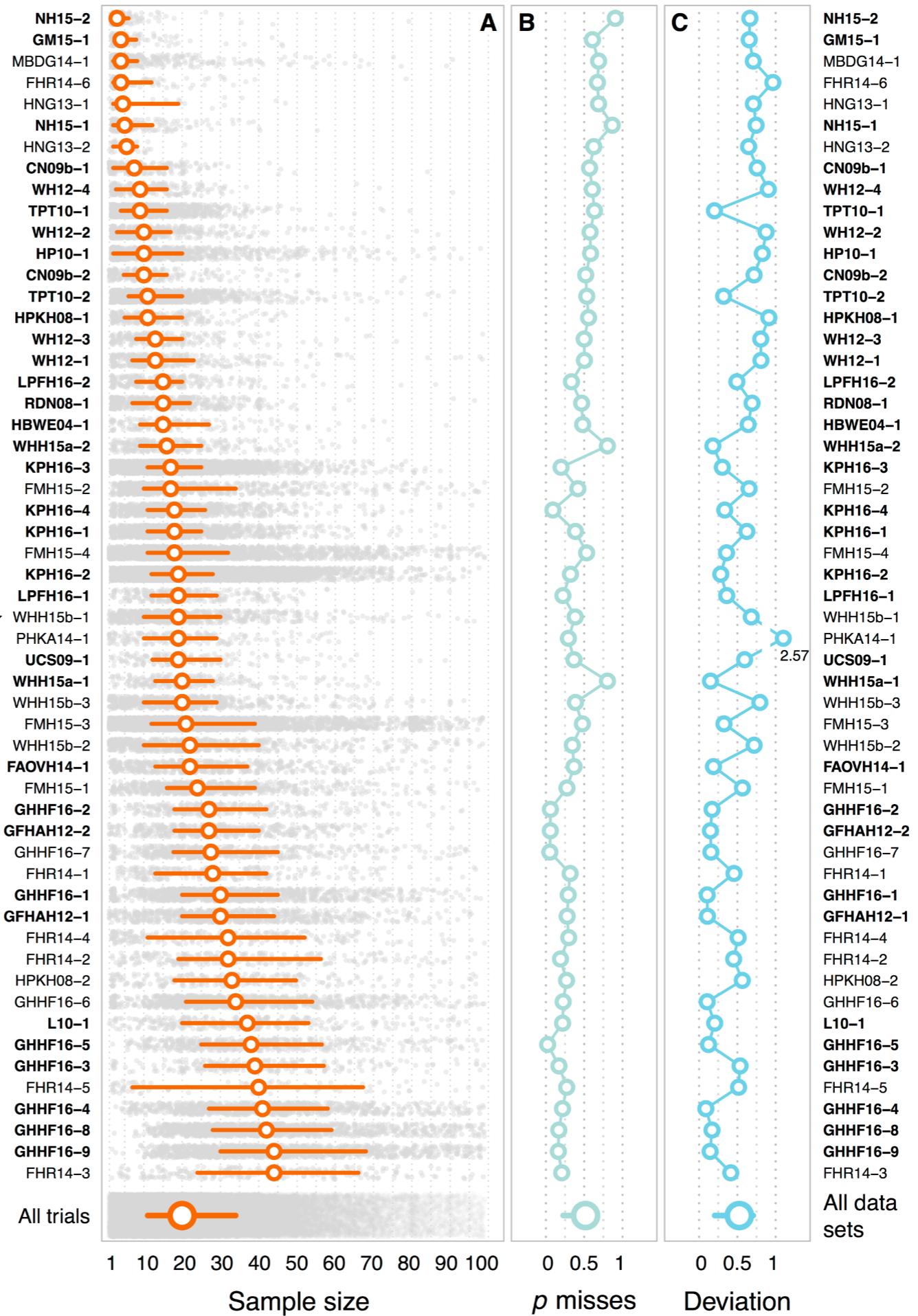
# Sample size outcome misses & error

**Hau et al. (2008)**  
High versus low  
rewards



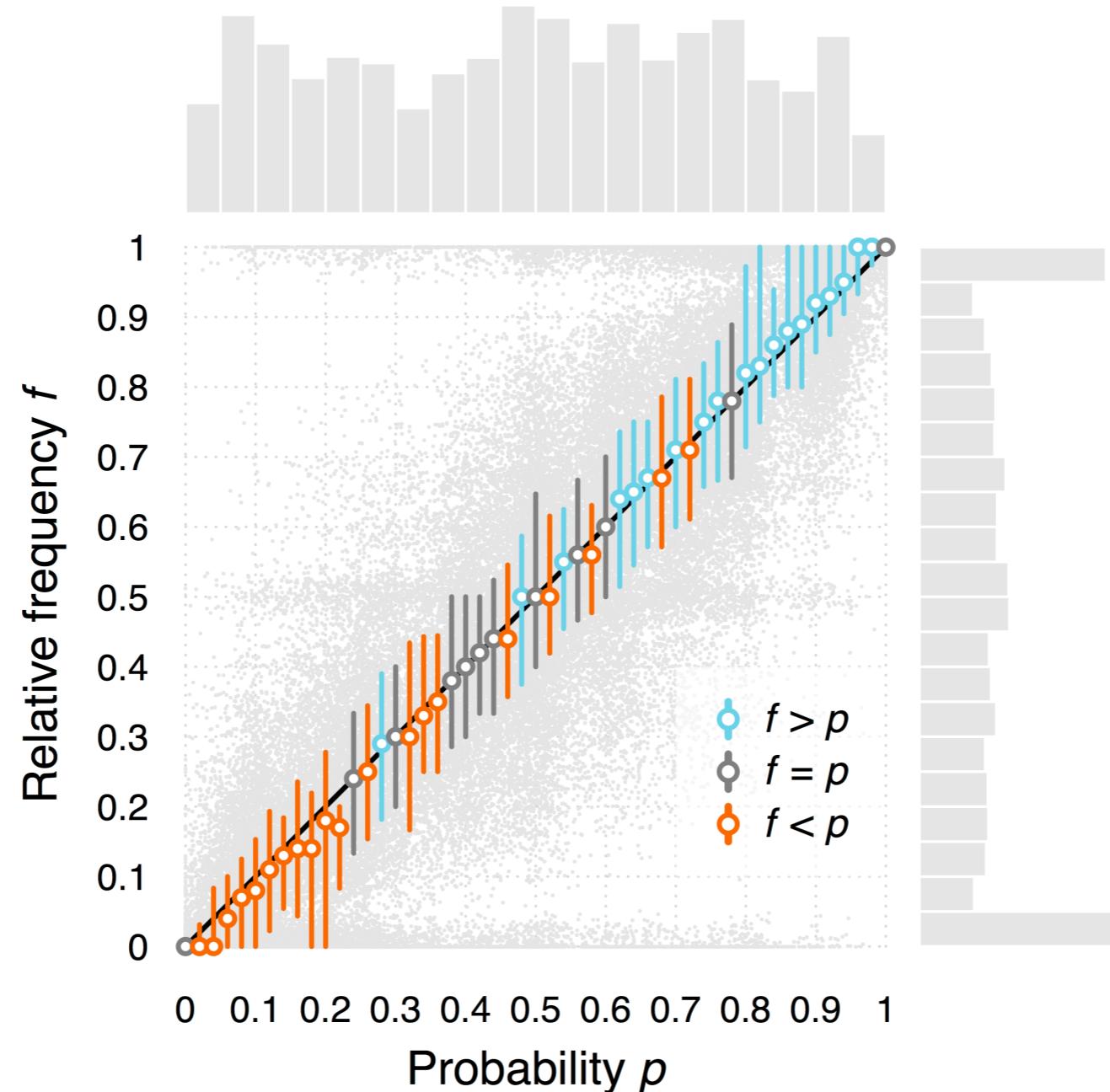
# Sample size outcome misses & error

**Wulff et al. (2015)**  
Long versus short  
run

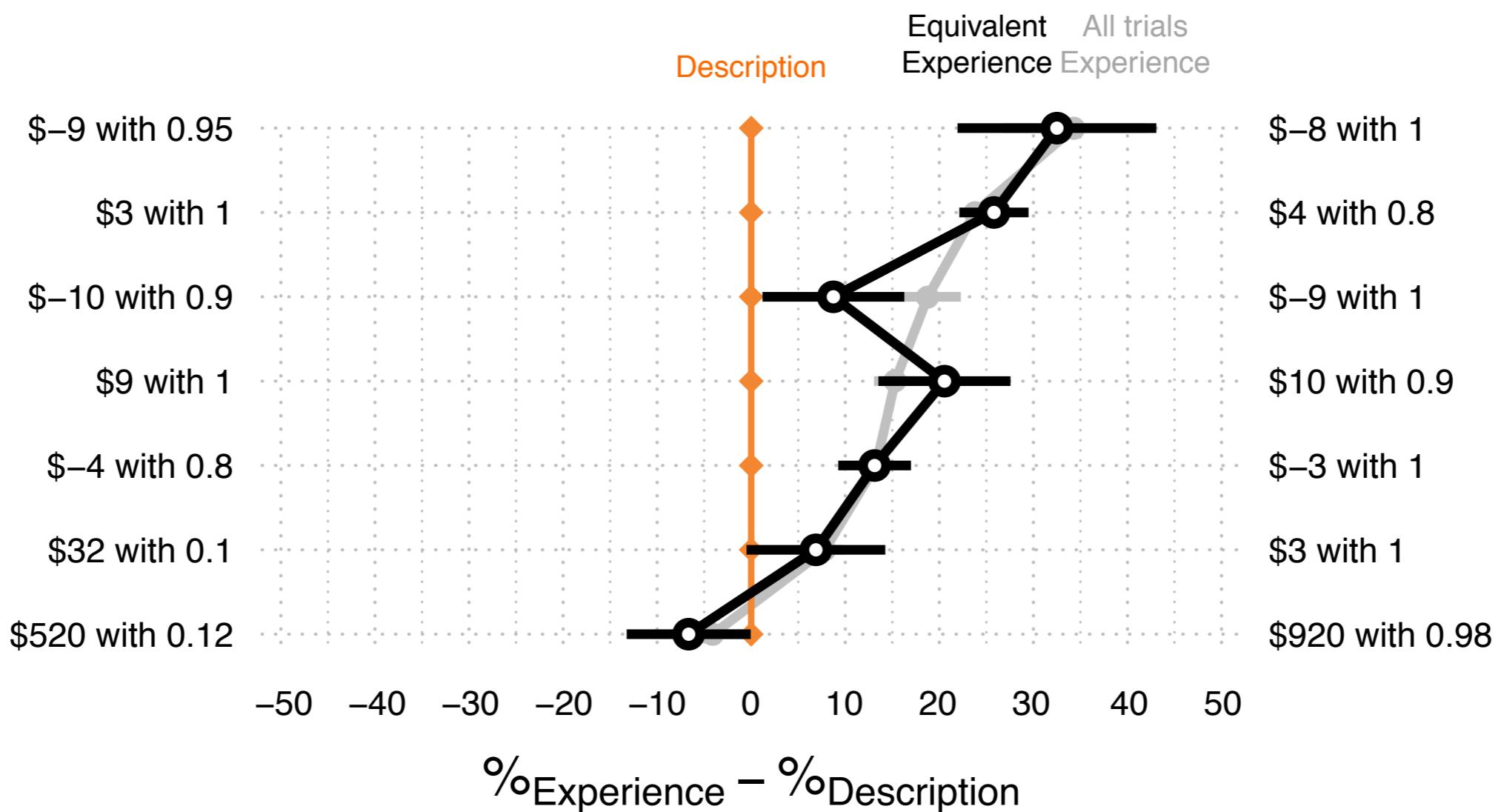


# Small samples polarise

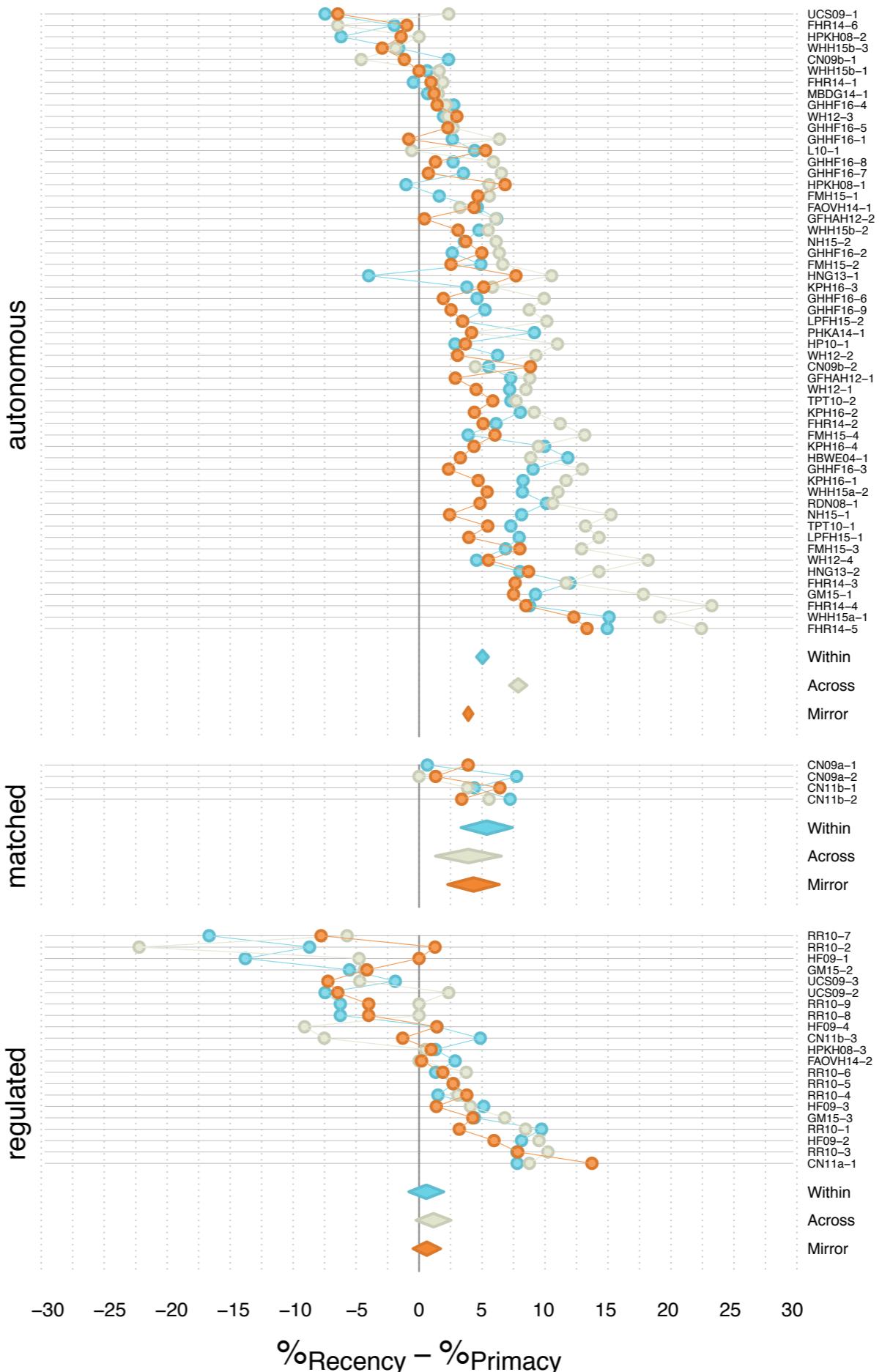
experienced relative frequencies vs. probabilities



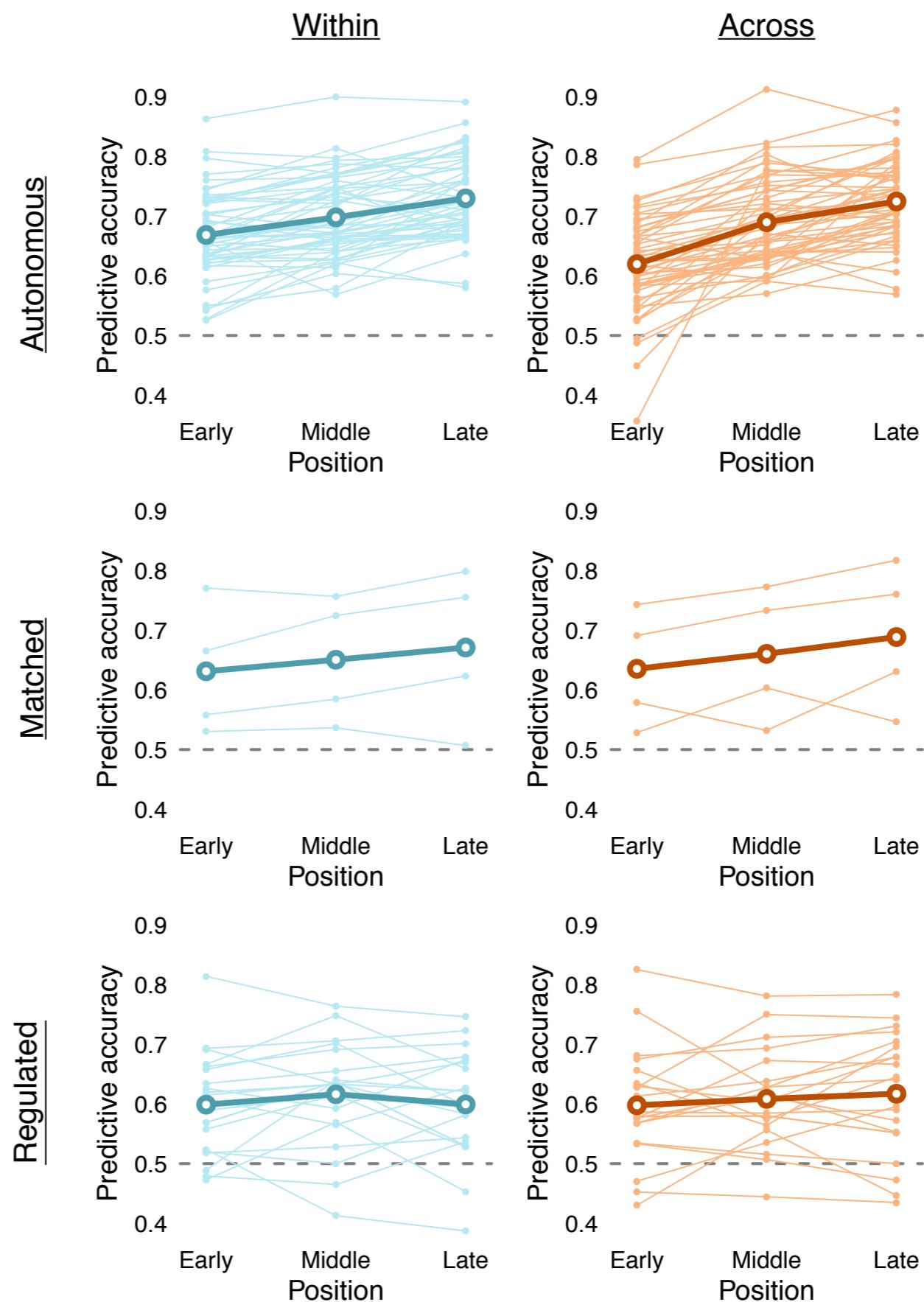
# Gap cannot be reduced to sampling error



# A robust recency effect in autonomous sampling

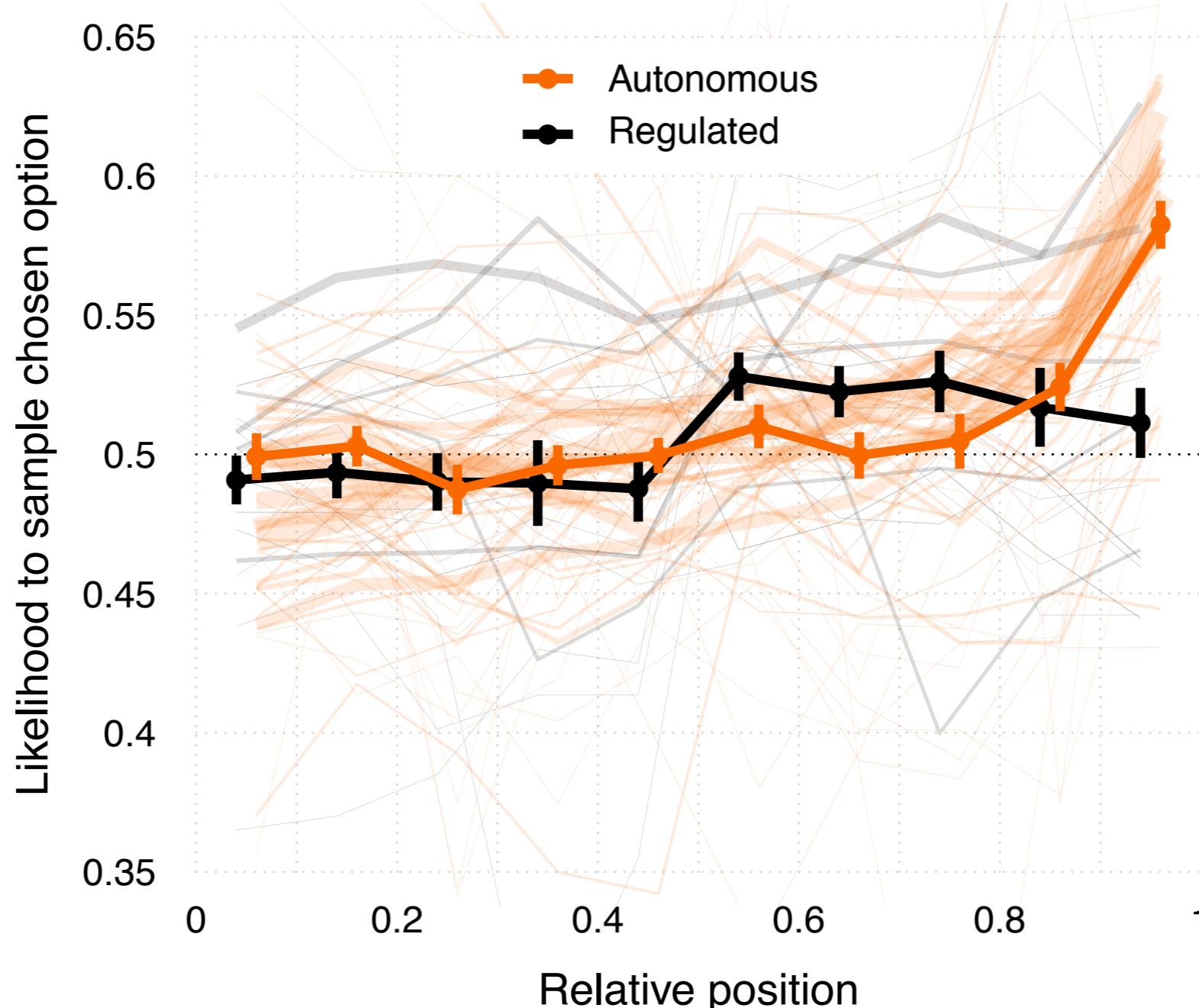


# Linear position weighting in autonomous sampling and flat in regulated sampling

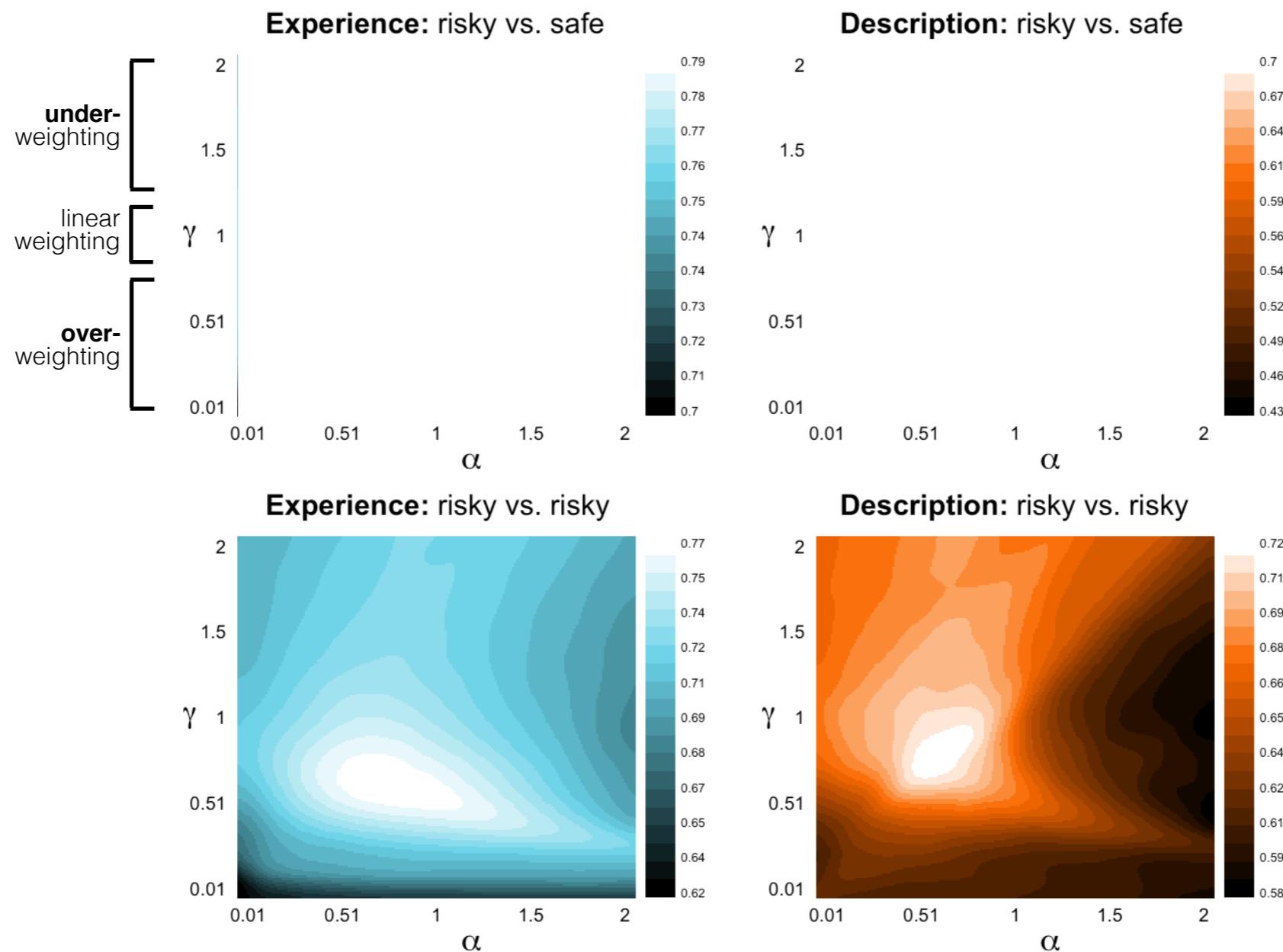


# Optional stopping

## A gaze-cascade-like effect

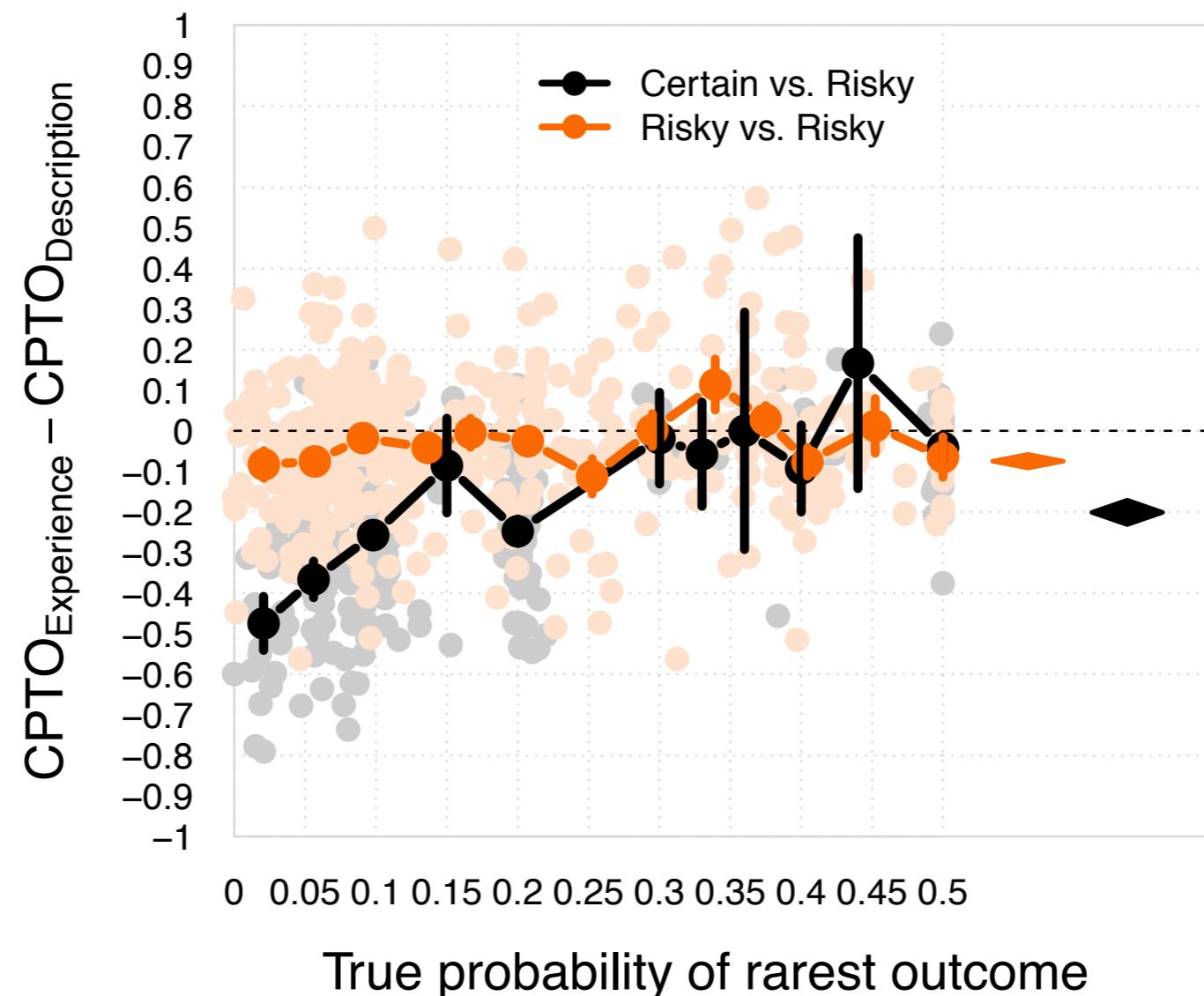


# Experience (may) elicit(s) linear probability weighting



# The gap is moderated by

- (a) the problem structure (risky vs. risky or risky vs. safe)
- (b) the probability of the rare event



# Conclusions

- I The gap is robust.
- II The largest factor is sampling error.
- III There is a gap beyond sampling error.
- IV Recency is robust, but it may not contribute to the gap.
- V Choices are consistent with different probability weighting across task and item formats, but mechanisms are unclear.



Max  
Mergenthaler



Ralph Hertwig

